1. INTRODUCTION

A man is a unique game of nature, built of a combination of genes and all he has lived through his life, ever since his conception to this very day thus being a system of two programs: genetic and syngenetic (Guntern 1980).

Shaped, developed and adapted to different conditions for millennia ... Yes, it is us as we are. And yet, imperfect and aware of that. But there has always been a wish to be different from the others. And we are. It is the speech that makes it possible. It is the unique and most complex human activity calling for concordance and harmony of the whole orchestra called: the body. Seemingly very simple, but in fact very complex. Today we still cannot be certain to say and explain what is going on in the human brain in the course of the speech activity. We can only guess. Science has advanced very much in explaining the anatomy and physiology of almost every body organ except the brain. What are the links and relations within the brain that appear during the use of cognitive functions of thinking, memorizing, speaking ...? They are interactively related to all biotic, mental and social structures woven into the structure of a man and they are determined individually. How? It is not known (Novosel/Kadežabek 1998).

A man has body and soul, and he can think and feel. A man is left only one day a week to fight and solve problems. But when today's burden is added to the one of yesterday and tomorrow, he collapses because he is not capable of carrying it all on his own. This is how many illnesses and disorders have started, disturbing the health in one way or another. The

---

1 Prim.dr.sc. Ivan Pavliček, neurologist, and Prim.dr.sc. Miroslav Pospis, pediatric neurologist, acted as reviewers (recenzenti) of this article.
pace of life today does not allow us to stop not even for a little while, because survival and existence are sometimes more important than we ourselves. We struggle here in big or small space, more or less successfully. In order to be successful we need SPEECH – the most important means of establishing quality relationship of any kind with other people. It is not possible to express opinion, wish, willingness, ideas, joy or sorrow without speech. Unfortunately, there are many people today who are deprived of the ability to speak. Those who are incapable of establishing human communication due to injuries or central nervous system illness have been struck most (Novosel/Kadežabek 1998).

2. CONDITIONS TO SUCCESSFUL REHABILITATION

Aphasia is not only the loss of the ability to speak or the speech and language disorder but also a syndrome of different neurological and psychological behavior. From our point of view it is not only the phenomenon of the central nervous system. Everything that happens on the intimate social plan just before and in the course of the rehabilitation plays an important role here as well (Eccles/Zeier 1984). Successful rehabilitation does not solely depend on the sort of aphasia and its degree or on a good therapist and a good program. It is not enough to rehabilitate and, if we may say so, to reactivate speech and language centers but also to create relational and interpersonal conditions that are going to stimulate reactivating or activating of these and other centers and to make their functioning possible (Eccles/Zeier 1984). That is why we consider it crucial for the rehabilitation of aphasia to know and use interpersonal dynamics of a patient inside the immediate family (Novosel/Brajša 1989).

Furthermore the next component that is necessary for the successful rehabilitation considers the changes in emotional dynamics, i.e. emotional distribution. Many authors agree that the psyhical is a relevant factor with aphasia patients, too.

The problem arises regarding the attitude towards the psychic sphere, since different authors allow for different aspects of the psychical. Some of them put the main stress on the cognitive sphere thus avoiding the emotional one.

2.1. Emotional dynamics with aphasia patients

A cerebral vascular insult leading to aphasia almost always causes changes in the emotional structure of personality. The most frequent changes are emotional apathy, depressive mood, hypersensibility, aggressiveness and the like. Changes of personality occur not only as an organic result of brain lesions but they are secondarily also due to the loss of speech, constant frustrations concerning illness or fatigue accompanied by the inability to speak. Emotional conditions are not only phenomena but also dynamic processes of personality that are strongly connected to the human body and can contribute to its healthy state or sick
conditions in many ways. Owing to the deficiency of diagnostic instruments for the emotional sphere, our research and experience show that Plutchik's test of emotions (PIE) has solved some of the essential problems concerning a more exact approach to the psychical dynamics of the emotional (Kuhar et al. 1989).

Example: Patient M.A., 54 years old, Dg: Status post CVI, Hemiplegia lat. dex., Aphasia sensomotoria.

PIE test was done by his wife. The results show strong depression (95%), the central problem of the personality being the fear of the loss of everything that is of value for him. Suicidal ideas or total apathy can always be found in depressed. Intrapsychic conflict is present concerning the relation 'happiness – sorrow'. In the initial phase of the rehabilitation the patient accepted the therapy with difficulty. Depression gradually disappeared owing to the good preparation and the change of the attitude of the family members towards the patient.

Globally speaking negative emotions are dominant in aphasia patients, that is depression, introverted nature, anxiety, passive aggressiveness, fear, and often an autoaggressive suicidal profile can be found.

Past experience with the PIE test brings us to the conclusion that in the course of rehabilitation the emotional sphere and its dynamics must also be taken into account as equally important factors for successful rehabilitation. Past analyses show that it is necessary, for the time being, to postpone rehabilitation with the patients with 'stronger negative emotional distribution' in the PIE and to work with them and their family in the meantime on the emotional plan so that they can be more realistic, objective and motivated in the correction of the speech and language disorder later on. An aphasia patient does not create emotional disturbance by himself. It is the consequence of a series of events both before and after the insult within the family and life context. Our experience shows that better results in aphasia rehabilitation are achieved when the handicap is "divided", especially in the family. Negative emotional fund measured by the PIE can be significantly reduced with time through our program which is based on the system, relative and circular psychodynamics. Each and every process of rehabilitation must have its width and depth in which all the aspects of human behavior are observed. With some of the patients it is not advisable to "go for" the basic symptom at once. It is more important to analyse other manifestations and changes as well, including the emotional sphere.

2.2. Interpersonal prerequisites in aphasia patients

In the course of the rehabilitation of aphasia patients the problems of interpersonal relations, interpersonal communication, interpersonal adaptation and interpersonal psychodynamics inside and outside the family must be taken into account.
2.2.1. Interpersonal family relations

The characteristics and the quality of marital and family relations of a patient are not insignificant. What matters is the relation between closeness and distance, symbiosis and individuation, symmetry and complementarity and directness and indirectness of these relations. Strong closeness, too intensive symbiotic joining, fixed complementarity and forced directness can have as negative influence on the development of the rehabilitation as the maximum distance, forced individuation, stimulated symmetry and functional indirectness. Both poles of the stated relative modalities must be equally represented. In the course of his qualification a patient needs both, not just one or the other. As a matter of fact it is the recreation of the situation in which he found himself as a child. Like before he now needs protective closeness, symbiotic joining and immediate love but with the aim of getting away from individuation, rivalry partnership and the functional usage of relationships. Owing to that it is necessary to work with members of the family in order to create conditions for his self-reliance and independent functioning (Brajša 1984a & b, 1985; Novosel/Brajša 1989).

2.2.2. Interpersonal family communication

This sphere also requires favourable communication conditions for as successful a rehabilitation as possible. Verbal communication is just one part of the whole communication complex. The family has to give the patient adequate stimuli on the level of non-verbal and relative communication, too, meaning it has to show and not just express its support, as well as define positively its relationship towards him and give him the opportunity to freely express his own feelings and experiences. According to the Hamburg concept of communication psychology our patient has got four "ears". With his first ear he listens to the content, with his second one he assesses his partner in communication, with the third one he contemplates the relationship offered to him, and with the fourth one he decides whether to use the message in his behavior or not. This influences his own communication with others and his verbal speech significantly. Only in stimulating surroundings can a patient start speaking faster and better and successfully speak longer (Brajša 1986a & b).

2.2.3. Interpersonal family adaptation

Only a fully adapted patient has the conditions for successful rehabilitation. It does not depend solely on him but also on the behavior and the adaptation to him of the others who are "significant" for him. What is important here is the flexibility to adapt oneself, heterogeneousness and reciprocity. Adaptation must not be rigid, homogeneous or one sided (Brajša 1990; Brajša/Ozimec 1986; Novosel/Brajša 1989).
2.2.4. Interpersonal psychodynamics

Our patient has his inner world, too, his experience and emotions, his feelings, all of it being a part of his relative interpersonal atmosphere. These are psychodynamic aspects of the interpersonal set of problems of our patient. He must be trained to verbalize not only the things happening between him and the family but also the things happening inside of him. If it is suppressed in him it can cause problems when he has to verbalize things happening around him. The suppressed experience of others around him, connected to him, plays an equally important role here. The patient feels it and sees it but possibly misinterprets it. It can also have negative influence on his speech abilities. It is the psychodynamic, often unconscious to him and others around him that must find a way to clear and unambiguous verbalizing in everyday communication between him and his environment (Brajša/Ozimec 1986; Kuhar et al. 1989; Novosel/Brajša 1989).

A lot of success has been achieved in clinics for speech therapy but it is diminished later on in the family and elsewhere if no favorable and adequate conditions for the maintenance and further development of the achieved rehabilitation results can be found.

Within this context the MODAKTh computer program is a complex stimulation system of four basic speech and language modalities. These modalities are speaking, understanding, reading and writing. They can be damaged by various brain injuries caused by either external or internal factors. One of the consequences caused by external and/or internal factors is aphasia, that is a speech and language disorder arising as result of the organic brain damage. These cerebral vascular incidents can occur due to embolism, when a blood clot obstructs a blood vessel and cuts off one part of the brain from supply. CVI also occurs due to bleeding, i.e. a blood vessel bursts, blood vessel ischaemia, due to tumor or abscess, arteriosclerosis etc. Aphasia can also occur due to brain injuries caused by external factors in traffic accidents or head injuries in war.

3. The MODAKTh program in aphasia therapy

Using the computer program MODAKTh, which stands for 'modality activation', can in various ways trigger certain mechanisms and relations in the brain, and with the aid of polysensory stimulation of all senses it is possible to 'awaken' certain centers, certain voices, words, combinations, and so on. The rehabilitation process of people suffering from aphasia is complex, hard and a long procedure in the context of which we try to render usable or rehabilitate some earlier functions, which were temporarily or permanently out of use, to the maximum extent and in that way reintroduce into functioning. One of the most difficult forms of rehabilitation is the rehabilitation of people suffering from stroke, especially where the speech-language function has been damaged, that is, where due to brain damage the communication chain gets brutally and
abruptly disrupted. The advantage of using MODAKT$_{hr}$ is that the patient can relatively well establish some kind of communication with the computer that speaks and leads the person through the process with the help of a speech pathologist. In so far as the rehabilitation process has been done in a 'pencil and paper' manner, the therapy was on a very abstract level. For example, if a patient was shown a picture of a bird, he would see the bird and the written word 'bird', which was still not enough information to make a connection. MODAKT$_{hr}$ introduces here auditive stimulation, namely, bird singing on demand (click), which enables quicker transmission of polysensory stimulation.

Apart from aphasia, the program can be used for other speech-language pathologies or disorders, for example, undeveloped speech in kindergarten children, problems with learning, dyslexia – problems with reading, dysgraphia – problems with writing, and partly for children with impaired hearing. The program in the hands of a good therapist, or a speech pathologist, will lead the patient to better results of the rehabilitation process.

4. MODAKT IN CROATIA

The Speech and Hearing Rehabilitation Department of the General Hospital Varaždin is where a team of experts work on the development of rehabilitation procedures. Amongst them, one should mention the long-term expert and scientific cooperation in that field of Professor Darko Novosel, Sc.D. speech pathologist and Tatjana Novosel, speech pathologist with a well-known aphasiologist Mike Roth, Ph.D., the author of MODAKT program, from the University of Konstanz in Germany. MODAKT came to Croatia in 1995. The first version was programmed for DOS in Turbo Pascal in German language. Its use created some problems related to the application of the program itself, scanning possibilities, simpler creation of exercises, use of Croatian letters, sound processing, etc. As they grew in number, the idea arose to start anew within Windows. That is how MODAKT$_{hr}$ was created, at the time, the only program in Croatia in Croatian language that could be used for the purpose of rehabilitation.

5. MODAKT$_{HR}$

This computer program has been written for Windows 95, in Delphi 4.0 and it uses Paradox base. The program had to meet the following multimedia requirements: use of pictures of different formats (*bmp, *.wmf, *.jpg), free sound recording through microphone and its processing (*.wav), option to use video format (*.avi), use of Croatian graphemes, interactive deciding option, writing and drawing by using the mouse or pencil, and additional O/I units, for example, scanner, graphic table, and the like.

Minimal required configuration is a 486 processor with 16 MB RAM, while the ideal one would be IBM Pentium/350 MHz or more, 64 MB RAM, floppy 3.5″, CD-ROM,
monitor 17", SVGA 2 MB, video-card, SB 64bit Pro, scanner, color printer, mouse, keyboard and tablet. A bigger hard disk is of advantage because of many pictures, sounds and films in the MODAKT program.

MODAKT\textsubscript{hr} comprises seven types of tasks related to speech-language processing (Mistric et al. 1994):
1. auditive comprehension
2. reading comprehension
3. producing written items
4. relation hearing – comprehension – reading
5. picture dictionary
6. writing and
7. dialogue.

These tasks extend through four exercises (MODAKT\textsubscript{hr} version 1.1):
1. LETTERS – this exercise combines auditive comprehension, comprehension of what has been read, writing and grapheme-phoneme association, that is, letter-voice visual stimulus (Picture 1.).

Picture 1.

2. TALKING PICTURES – combines visual detail with text and sound in the context of written and oral comprehension (Picture 2.)
Picture 2.

3. FILM – enables demonstration of activities and answering questions (Picture 3.)

Picture 3.

What are people doing?
He is dancing.
They are walking.
They are dancing.
They are running.
4. FILLING IN – in this exercise a patient reads and hears a certain task in the form of picture or text and then fills in the missing graphemes (letters, words). This is a training of sound analysis and synthesis.

Picture 4.

Each of these exercises is created by a speech pathologist in a special, but simple way, depending on the aphasia type and patient's interests, defining the location of picture, sound and video files, with additional processing options. It means that, if, before aphasia the patient worked in an office, the rehabilitation will begin, for example, with naming objects found in such a place (picture + text + sound); for example, pencil, paper, notepad, chair, desk, computer, calculation, and so on – from simpler to more complex things and concepts.

It makes speech pathologist's work easier in saving his voice and enabling the presentation of some things and concepts that can rarely be created for the purpose of rehabilitation, for example, raining or snowing (*.avi), bird singing or dog barking (*.bmp, *.wav or *.avi), picture and voice of a family member (*.bmp, *.wav) …

Such polysensory stimulation in a shorter period of time leads to improved functioning of all four speech-language modalities – speech, comprehension, reading and writing, and thus enables quality communication with the environment. Apart from that, the program has 'Personal Data Files' holding basic data of a patient, speech pathology findings, diagno-
sis from the International Disease Classification and a choice of exercises for each patient (Novosel/Kadežabek 1998).

As important as the medical and already mentioned prerequisites of successful rehabilitation of aphasia patients, is the expert team that plans, creates and carries out the whole rehabilitation program. Each program has to be individually prepared for each patient and must be open to certain corrections and additions.

6. BIBLIOGRAPHY

Brajša, P. 1984a Rukovođenje kao međuljudski odnos, NIŠRO Varaždin.
1984b Sreća ili nesreća u dvoje, NIŠRO Varaždin.
1985 Ljubav i svada u dvoje, NIŠRO Varaždin.
1986 Se da živeti u dvoje, Delavska enotnost, Ljubljana.
1990 Drukčiji pogled na brak, Globus Zagreb.

Darko Novosel, Speech Pathologist, General Hospital Varaždin, Croatia
Tatjana Novosel, Speech Pathologist, General Hospital Varaždin, Croatia
Volkbert M. Roth, University of Konstanz, Germany
VAŁMOD PROGRAM
MULTIDIMENSIONAL APPROACH TO THE THERAPY OF STUTTERING

1. INTRODUCTION

Human brain is associated with interpersonal communication where special attention is paid to the liaison brain and modules, a special group of neurones which function differently from other parts of the brain, that is, they behave according to the rules of exchange of information. The brain can be activated or pacified, in other words, its modules can open or close, they can function or cannot function, depending on the dynamics of interpersonal communication. Modern science on the development and functioning of the central nervous system draws our attention to the fact that brain is a "relative organ", meaning it is essentially connected in its operation and functioning to the intensity and quality of the immediate relationships with the other significant organs within the vital relevant interpersonal systems. Consequently, central nervous system is not only genetically determined, neuroanatomically and neurophysiologically interpreted, but it is significantly connected to the relative interpersonal atmosphere, to what is happening on the intimate social relative plan (Eccles/Zeier 1984).

Each individual should and must communicate within its natural systems with different partners. Speech, as the basic means of communication, holds a special position and significance in quality and realisation of communicative goals. Regardless of its origin, every system owns its balance to a built-in system of control, which receives information, compares them with the established standards, decides on the amount and the direction in which the correction should be made, in accordance with the approved information.

In the framework of automatic regulation, speech is a very complex regulatory system with rigorous criteria for its own stability, linked with and in direct connection and function with many other systems in the body. The feedback principle is the basic characteristic of every system in the human organism, while the integrative role from the smallest segment to the functional parts and the whole belongs to the nervous system. So, the basic principle of the theory of regulation is feedback and without it a certain function cannot be adequately realised (Novosel, D. 1992a).

In such a context stuttering can be observed as an instability in the regulatory system, which does not include feedback and the necessary information on the occurrences within the system, and without regulation this leads into even greater instability of the system.

1 Prim.dr.sc. Ivan Pavliček, neurologist, and Prim.dr.sc. Miroslav Pospis, pediatric neurologist, acted as reviewers (recenzenti) of this article.
Regarding the etiological variety in approach to the problem of stuttering and the existence of different theories and explanations, the very treatment of stuttering poses no smaller a problem and mystery. Stuttering is a kind of speech disorder or interpersonal communication disorder the consequences of which differ from one person to another. Due to manifold system and complex speech and language functioning which requires a high functional harmony in its every segment, there are relations which, due to their sensibility, get more or less disturbed at a certain point. This disturbance suffices to disrupt the speech and language process and the speech and language productive component at that moment.

2. PREVIOUS RESEARCH

Our research started at the Speech and Hearing Rehabilitation Centre of General Hospital Varaždin in 1982.

2.1. Neurorisk Factors

It all started with the research of neurorisk factors in prenatal, perinatal and postnatal period on a sample of 45 stutterers and 45 non stutterers aged between 9 and 14 (Novosel, D. 1982a & b).

The incidence of neurorisk factors in prenatal, perinatal and postnatal period is found to be in the ratio 4:1 in favour of stutterers (Chart 1.).

Chart 1.
Incidence of neurorisk factors.

The most frequent of all neurorisk factors are complicated pregnancy, prematurity, postmaturity and abnormal neurological signs (Chart 2.).
2.2. Motor coordination of movement

The same sample groups were used to test the speed of leg tapping (Chart 3.), hand tapping (Chart 4.) and hand coordination (Chart 5.). According to the results, children stutterers displayed a statistically important difference in motor coordination ability, compared to the control group (Novosel, D. 1982a).

Chart 3. Leg tapping

no significant difference in speed of leg tapping between stutterers and non stutterers
2.3. EEG Findings

Many previous research into the relation "EEG – stuttering" have given different results. Assuming that the presence of neurorisk factors and differences in motor coordination can be predispositions for elements of organically based stuttering, a research has been launched into electric brain activities on a sample of 44 stutterers and 42 non stutterers of both sexes aged between 9 and 14. The results show there is no statistically significant difference in EEG findings results between these two groups. Neither is there a difference between stuttering intensity and EEG findings. Regarding the chronological age of persons
while using provocative methods (photoaudiostimulation, hyperventilation), a mild disruption of the main cerebral rhythm occurred, which is normal with unfinished brain electrogenesis (Chart 6.) (Novosel/Brestovci 1988; Novosel, D. 1982a).

*Chart 6. EEG findings.*

- no significant difference between stutterers and non-stutterers
- no correlation between the intensity of the stuttering and the EEG findings

---

2.4. Photopletismography

Photopletismography (*Image 1.*) showed that people with severe stuttering (N = 9 persons, chronological age between 16 and 24) have normal pulse frequency and normal curve of the photopletismogram in the phase of relative relaxation and silence. In the prephonatory phase the pulse frequency rises and the curve of the photopletismogram lowers, which means that the blood flow on periphery is reduced. These differences are even bigger in the speech phase. Two seconds after speech the pulse frequency lowers and blood flow is normalised. These changes also point to the alarming situation occurring just before and during speech production (Detoni/Novosel 1989).

*Image 1. Pulse and Photopletismography by severe stuttering*

The frequency of the pulse (upper line) and the curve of the photopletismogram (lower line) in the phase of the relative relaxation and silence.
The frequency of the pulse (upper line) and the curve of the photopletismogram (lower line) in the prephonatory phase.

The frequency of the pulse (upper line) and the curve of the photopletismogram (lower line) in the phase of speech.

The frequency of the pulse (upper line) and the curve of the photopletismogram (lower line) two seconds after the speech (silence).

2.4. Pulse and blood pressure

When taking pulse and blood pressure, a statistically significant difference has been established between stutterers (N = 44 persons) and non stutterers (N = 44 persons) (Chart 7.). Charts 8. and 9. show significant differences in measured parameters before and after therapy in the stutterers group (Novosel, D. 1982a).

*Chart 7.* Blood pressure in the phase of silence and speech phase in the stutterers group and non stutterers one.

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Stutterers</th>
<th>Non Stutterers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silence</td>
<td>110, 124</td>
<td>113, 138</td>
</tr>
<tr>
<td>Speech</td>
<td>121, 145</td>
<td>118, 138</td>
</tr>
</tbody>
</table>
2.5. Emotional dynamics

Research into emotional dynamics of stutterers (N = 41 persons, chronological age between 9 and 16) using Plutchik model PIE (Profile Index Emotion) has shown that stutterers display a high degree of anxiety, namely caution and fear as dominant emotions. Chart 10 shows an example of such negative emotional distribution (Ozimec/Novosel 1985).
2.6. EMG Biofeedback

One of numerous researches on a sample of 45 stutterers and 45 non stutterers, chronological age between 15 and 24, and which was of a special significance for therapy strategy, was measuring the muscle tension and the duration of larynx muscle tension using special Ghetaldus - 161 electromyograph and program. The research proved statistically significant difference in the presence of higher larynx muscle tension in prephonatory speech phase of stutterers. It has also confirmed that the contraction duration significantly influences the stuttering intensity (Novosel, D. 1990; Novosel/Novosel/Novosel 1999; Novosel/Ribić 1984, 1985, 1986; Novosel, T. 1996).

The EMG biofeedback techniques is rather widely applied in the therapy of stuttering, but even in such treatments there are some understatements, disagreements and differences (not meeting the criteria of the biofeedback technique, small groups of examinees) which should be further scientifically tested (Beaty 1980; Freeman 1985; Ham 1986; Hanna et al. 1975; Kalotkin et al. 1979; Peters et al. 1989). Because of these differences Novosel/Ribić
(1984, 1985, 1986) designed equipment with computer programme developed only for the EMG biofeedback technique. *Ghetaldus 161 – EMG biofeedback* equipment registers the frequency of impulse appearance, that is, we measure time (t). The shorter the time of impulses is, the higher the voltage (integrated potentials). It is recommended to record the muscular contraction, which is proportional to the frequency of the impulse appearance. Summing up the integrated muscular signals, we obtain relatively high voltage which changes slowly and suitable for biofeedback. These advantages enable to registration of even the smallest change inside the muscle we observed. Our experience has proven that this way of recording is the best, so the units on the instrument actually show psychological contractions and it is not calibrated in frequency or voltage. We cannot talk about the voltage of a single impulse as we deal with integrated voltage. This is the degree of contraction, in other words, what we can see and what we are interested in is only the area from the relaxation to the highest contraction (Novosel, D. 1990, 1996).

This essential difference makes direct comparison of the obtained results by the two measuring methods impossible. *Ghetaldus 161 EMG biofeedback* equipment cannot be used in diagnostics because of the mentioned reasons. On the other hand, a standard EMG equipment cannot be used successfully for the biofeedback technique without an additional adaptation and processing of the signal (Novosel, D. 1996).

3. APPROACH TO STUTTERING

*VaLMod program* (Varaždin speech pathology model) has been created on the basis of findings results. It approaches and examines stuttering from four basic aspects:

1. aspect – medical aspect
2. aspect – interpersonal dynamics of stuttering
3. aspect – individual psychodynamics of stuttering
4. aspect – physiology of stuttering.

3.1. Medical aspect of stuttering

Medical aspect of stuttering involves collecting all relevant information concerning inheritable component of stuttering, neurorisk factors in prenatal, perinatal and postnatal period, intra-uterine stress, illnesses and disorders in early childhood in order to establish the level of risk. If risk factors are discovered in the period of pregnancy, delivery and postnatal period, 'risk child' is under frequent control of neuropediatricians, psychologists and speech pathologists, so that possible development differences in all segments, including speech and language development, are observed in time. Information so obtained can give a partial...
answer to complex etiological component of stuttering, later on extended and supplemented with new information and insights.

Every one of us represents a combination of genetic and syngenetic program (Guntern 1980). Between genetic and syngenetic program there are medical, or rather neurorisk factors which can create 'fertile ground' for the occurrence of stuttering. Whether every risk child will develop a stutter depends on other factors and syngenetic program circumstances, as well (Image 2.).

*Image 2. Medical aspect of stuttering.*

3.2. Aspect of interpersonal dynamics of stuttering

Interpersonal dynamics of stuttering refers to the analysis of the quality of human relationships in different natural settings: in family, at school, at work and among friends. Such information forms basic characteristics for the syngenetic program, which is basically everything experienced and imposed by education and upbringing. In a family context, for example, any too close a connection or a lack of the same between the members of the family can be one of the frequent provocative and maintaining factors of stuttering. The degree of quality of interpersonal relationships in relevant natural settings is an important insight for the analysis of occurrence and duration of stuttering, but also an important component for a possible correction during and after the therapy procedure. In the way they work (intensity and duration of stress factors) disturbed interpersonal relationships in a
family or at school can be the main etiological factor for the occurrence of stuttering on already 'fertile ground', or a maintaining factor of stuttering at work *(Image 3.)*.

*Image 3.* Interpersonal dynamics of stuttering aspect.

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>conflicts, dispute</td>
<td>impatience of professors</td>
</tr>
<tr>
<td>lack of understanding</td>
<td>unpedagogical treatments</td>
</tr>
<tr>
<td>lack of tolerance</td>
<td>injustice in giving of marks</td>
</tr>
<tr>
<td>lack of communication</td>
<td>lampoonery jeering</td>
</tr>
<tr>
<td>inflexibility</td>
<td>feeling of worthless</td>
</tr>
<tr>
<td>parent’s opinionatedness</td>
<td></td>
</tr>
<tr>
<td>distrust to children</td>
<td></td>
</tr>
<tr>
<td>lack of time for children</td>
<td></td>
</tr>
<tr>
<td>alcoholism</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WORK</th>
<th>GENERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>hard to find a job</td>
<td>reduced acquaintance of friends</td>
</tr>
<tr>
<td>problem of communication</td>
<td></td>
</tr>
<tr>
<td>lampoonery jeering</td>
<td>lack of going out</td>
</tr>
<tr>
<td>degradation</td>
<td>lack of companionships</td>
</tr>
<tr>
<td></td>
<td>undesirable in the society</td>
</tr>
<tr>
<td></td>
<td>lampoonery jeering</td>
</tr>
</tbody>
</table>

3.3. Aspect of individual psychodynamics of stuttering

Individual psychodynamics of stuttering refers to the analysis and testing of every patient's emotional dynamics before the therapy, so as to obtain an insight into the emotional distribution/dynamics. On the basis of the information obtained, the strategy of therapy is planned. It has already been mentioned that the main characteristic of patients stutterers is high anxiety, that is, dominant emotions of fear and caution sprung from the problems in interpersonal communication and relationships *(Ozimec/Novosel 1985)*. Any unsuccessful communication is a failure, sometimes even a trauma. It is an everyday experience which is being internalised. Any bad experience which is internalised and not verbalised becomes everyday anguish and the subject of negative thinking. Long-term battle against stuttering reduces a person to a state of chronic exhaustion and negative emotional distribution. Our thoughts are then dominated by negative connotations of any given subject, while the unconscious and irrational dictates our behaviour.

3.4. Aspect of physiology of stuttering

Physiology of stuttering involves various measurings (pulse, blood pressure, photoplethysmography, sonogram, time of phonation, respiration, EMG, etc.) in the context of particu-
lar systems of the complex speech and language mechanism, and in order to establish the changes in prephonatory, phonatory and postphonatory phase. All the physiological changes are important parameters for getting an insight into the whole background of stuttering, because some of them, due to their strong emotional effect, influence directly or indirectly the intensity of stuttering and side-manifestations. These physiological changes are often invisible, but they are an important factor in determining the intensity of stuttering.

All four aspects through which VaLMod considers stuttering are interrelated and influence each other. Leaving aside all the depths and complexities of etiology (neurophysiology, electrophysiology, biochemistry, etc.) and based on our research, the following assumptions may be formed:

- genetically burdened children, children suffering from intra-uterine stress, children with risk factors in prenatal, perinatal and postnatal period are more often prone to various and manifold development disorders, including stuttering;
- the quality of interpersonal dynamics in and out of the family context is an important component for the development of a healthy personality. Any occurrence of negative interpersonal relationships and persistent tensions is a cause for loud reaction on emotional and physiological level with risk children, due to their sensibility, and given the 'fertile ground' it can provoke and later maintain stuttering;
- long-term exposure to low-quality interpersonal relationships in family, at school or at work, in time leads to emotional and autonomous exhaustion resulting in negative emotional fund domination and different symptomatology in verbal and non-verbal behaviour;
- such an emotional state, dominated primarily by emotions of fear and caution, results in significant changes of speech physiology, namely, in disturbance on the relation 'emotional dynamics – speech physiology', followed by reversible changes in cardiovascular, nervous, endocrine, muscle, respiratory and other systems.

Previously mentioned research and experience poses the following questions:

- Is there a neurological basis to stuttering?
- Is stuttering a neurosis?
- Is stuttering an emotional disorder?
- Is stuttering a problem of interpersonal communication?
- Is stuttering a problem in creating new interpersonal relationships?
- Does stuttering present a problem in choosing a profession and job?
- Is stuttering a result of complex speech physiology disorder?

We believe that the answer to these and many other questions can be affirmative. Due to this very etiological complexity, the conception of VaLMod program is more directed to-
wards quality and multidimensional approach in diagnostic, as well as in therapeutic segment (Novosel/Novosel 1997).

4. THERAPY OF STUTTERING

VaLMod program is a holistic and self-regulatory program incorporating a variety of techniques and procedures in the therapy of stuttering, only a few of which are mentioned here:

- relaxation
- self-suggestion
- respirational and phonatory training
- myofunctional exercises with coarticulation
- EMG biofeedback with regulation of muscle dynamics through prephonatory, phonatory and postphonatory phase
- intensive interpersonal communication
- corrective and educational work with members of the family.

Each of the above-mentioned techniques and procedures has an elaborate strategy and well-defined goals to be achieved in accordance with therapy dynamics.

One should point out that the essence of VaLMod program is the EMG biofeedback technique with regulation of muscle dynamics through prephonatory, phonatory and postphonatory phase, but in a variety that is totally different from the standard one (Novosel/Ribić 1994).

From emotional and physiological chaos to polyvalent psychogenic symptomatology in verbal and non-verbal behaviour, the objective of VaLMod program is primarily to establish emotional and physiological conditions for the vocal and motor realisation, which is accomplished through development and formation of feedback as the basic factor of stability in every system (Novosel, D. 1992b, 1994).

As a self-regulatory technique, EMG biofeedback records, analyses and outlines the integrated muscle potential by using a special Ghetaldus 161 biofeedback instrument, program and computer backing in the range of the vocal and speech, muscular and respiratory systems. Along with other techniques and procedures it consciously contributes to stabilising one or more active systems of the speech mechanism. In other words, the data are meant to be recognised by patients so that they can learn how to control their normally unconscious activities.

One of the biggest advantages of biofeedback is the fact that problems get solved in a natural way, with the main accent being put on patients so as to make them aware of their capacity to control a wide range of physiological processes (Novosel, D. 1990).

In the case of a patient suffering from intensive stuttering before the therapy started, a higher level of muscle tension in the laryngeal zone (spasm) taking place for up to three seconds before the first spoken word, that is, before speaking starts, was noticed, which can
be seen in *Image 4* (Novosel, D. 1995, 1996). Statistical analysis has established an important correlation between the intensity and duration of muscle contraction in the prephonatory phase in relation to the intensity of stuttering (Novosel, D. 1990).

*Image 4*. Acoustical registration and EMG – biofeedback before the therapy.

Measuring acoustical intensity by means of a spectral analyser has shown that speech is characterised by an increased level of emotional and energetic charge, which results in a higher acoustical intensity exceeding 90 dB (*Image 5*).

*Image 5*. Acoustical intensity of speech before the therapy.
After a few days' intensive therapy the acoustical speech signal and muscle dynamics can be synchronised to a satisfactory degree. In Image 6, it can be observed that there is no muscle contraction before the moment of speaking; the muscles in the laryngeal zone are activated simultaneously as words are pronounced. These corrections, along with some other arising in the segment of respiration, phonation and coarticulation lead to satisfactory speech fluency.

Image 6. Acoustical registration and EMG – biofeedback after the therapy.

The spectral analyser records the speech intensity at ca. 60 dB, which is within normal limits (Image 7).

Image 7. Acoustical intensity of speech after the therapy.
In the course of therapy optimum physiological conditions enabling a more fluent speech realisation tend to be obtained. In view of that, correction is initiated on the plane of SPEECH PHYSIOLOGY, which includes respirational and phonatory training, myofunctional exercises with coarticulation assisted by a special computer program and instrument, as well as EMG biofeedback technique. Improved speech fluency initiates certain positive changes on the emotional plane, so that anxiety and fear gradually decrease, whereas joy and spontaneity are on the increase. Once these new conditions have been obtained and are consciously controlled, one can proceed to the main phase in which the ability of the accomplished emotional and physiological balance to be maintained is checked. This means direct INTERPERSONAL COMMUNICATION with unknown people in the street, agencies, shops and telephone calls.

VaLMod program therapy is administered in General Hospital in Varaždin throughout 12 days, 15 hours a day. Owing to complexity of both stuttering and the program itself, patients aged 14–60 are included in the therapy.

At the end of it, CORRECTIVE AND EDUCATIONAL WORK with parents, family members and spouses occurs, which can be considered the most difficult segment of the program. What makes it so difficult? After a 12-days' intensive therapy in General Hospital in Varaždin, the patient returns to their natural systems (family, school, college, workplace) where stuttering arose in the first place and, for some reason, persisted for years.

Each member of the family should know that this natural system can function adequately and has to do so, which things need to be changed, who needs to be changed and for what reasons, how communication can be improved, bearing in mind mutual adjustments that have to be made in order to obtain conditions for maintaining the emotional and physiological balance consistently, without which speech fluency, satisfying interpersonal relations and communication are not possible. Among 70 variables against which quality and dynamics of interpersonal family relations are measured, only a few problems that our patients are likely to face will be pointed out.

When asked with whom they can openly discuss about stuttering and other problems, out of 156 patients of both sexes, aged 10 to 48, 64% answered with 'both parents', 22% 'with mother only', 7% 'with a sibling' and almost less than 1% 'with father only' (Chart 11.). Chart 12. shows the frequency of these talks in which the 'occasional' category predominates.
When asked whom they trust most within the family, 56% said they trust \textit{both parents}, 28\% trust \textit{only their mother}, even fewer trust a \textit{sibling} and only 3\% their \textit{father} (Chart 13.).
When asked who they would turn to for help or advice if faced with an important problem, 38% of those examined would talk to both parents. About 20% of them would look for help and advice outside the family, talking to friends rather than their mother (19%). 12% would turn to their siblings, whereas only 5% would ask their father for help or advice (Chart 14.).
The question about who, in their opinion, has played a more important role in their upbringing and education throughout their lives, has given the following interesting results: an almost equal number is related to upbringing in which both parents have taken part (47%) and that in which only the mother has done so (42%), 6% is related to upbringing supported by grandparents and only 3% to that in which only the father has taken part (Chart 15.).

Chart 15.

5. THERAPY RESULTS

So far over 2500 patients have been included in VaLMod program. According to statistic parameters it can be concluded that 70% of our patients end their therapy with success, whereas the other 30% manage to reduce stuttering by only 50% (Novosel/Brestovci/Prizl 1993).

The criteria for quality and evaluation of speech fluency at the end of therapy are extremely strict and they apply to different conditions of speech and communication in which variables are evaluated:

- Fluency level in a monologue in mother tongue (discourse)
- Fluency level in a dialogue with unknown collocutors
- Fluency level in reading in the mother tongue and in a foreign language
- Fluency level in communication on the telephone
- Fluency level in schoolchildren upon being examined
- Fluency level in telephone conversations with former patients
- Fluency level in lectures
- Fluency level in front of the video camera during the final recording.
The expert team evaluates and assigns points to all the variables which finally leads to a conclusion about therapy results. It needs to be mentioned that each individual is not only self-evaluated but also discussed on the part of the group which makes conclusions about the results achieved.

Here is a brief outline of results achieved in VaLMod program therapy on the sample of 106 patients, 80 men and 26 women, aged 16 to 43, who received therapy in the first six months of 1999 (Chart 16.).

It can be stated that the differences in results obtained by measuring the intensity of stuttering by means of the test for evaluating stuttering intensity (Riley 1972) before and after therapy are not only statistically significant but also on average tend to be six times less pronounced in the second measuring.

Comparative analysis of self-evaluation of stuttering in 50 patients of both sexes, aged 12 to 39, before and after the VaLMod program therapy has shown that there is a considerable difference in self-evaluation of stuttering, which speaks in favour of therapy efficiency (Pizek 1998).
After 12 days, the ambulatory therapy is continued within the framework of natural systems and goes on under our supervision for up to at least one year.

It should be emphasised that VaLMod program is not only a program to be applied in therapy of stuttering and dysphonia. Owing to its multidimensional approach and therapy aimed at creating and maintaining the inner balance and physiology as a whole, it is above all a program for successful, accomplished and happy life (Image 8.).

It is a program for everyone, since within natural systems an optimal cohesion, cooperation, relations, communication and mutual adjustment have been established.
VaLMod program has received a gold medal in the field of medicine at the 23rd International invention fair Geneva 1995, at the International invention fair IENNA at Nürnberg it received a gold medal for the scientific concept and the results achieved in the stuttering therapy and a gold medal at INPEX XIX International invention fair in Pittsburgh 1998 in the field of therapeutic.

6. BIBLIOGRAPHY


Novosel, D. 1982a Komparativna EEG analiza u djece koja mucaju, Magistarski rad, Medicinski fakultet Sveučilišta u Zagrebu.


1990 Elektromiografska bioološko-povratna veza i mucanje, Disertacija, Fakultet za defektologiju Sveučilišta u Zagrebu.


1992b Povezanost razine napetosti mišića larinksa i jakosti mucanja, Znanstveni skup, Istraživanja na području defektologije, Zagreb.


Novosel, D./Brestovci, B./Prizl, T. 1993 *Praćenje nekih parametara u terapiji mucanja kroz program EMG biološko povratne veze, Multidisciplinarni pristop v logopediji, 4. strokovno srečanje logopedov Slovenije, Portorož.


1985 *Primjena kineziološke EMG biološko povratne veze u tretmanu mucanja, Zbornik radova I. Kongresa logopeda Jugoslavije, Opatija.

1986 *Aparatura za EMG biološko povratnu vezu kod terapije mucanja, XXX Konferencija ETAN-a, Herceg Novi.

1994 *VALMOND program, I. Kongres logopeda Hrvatske, Varaždin.*


Dr. Darko Novosel, Prof. Speech Pathologist
Tatjana Novosel, Prof. Speech Pathologist
Ingrid Novosel, M.D.

General Hospital
Speech and Hearing Rehabilitation Activities
Varaždin, Croatia